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Preoperative and Postoperative Pain (VAS) and Disability (ODI) Scores in Lumbar Disc Herniation

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Abstract

Background: Lumbar disc herniation (LDH) is among the leading causes of musculoskeletal disability worldwide. Surgical intervention is commonly indicated when conservative management fails to provide adequate relief. The Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) are well-validated tools for quantifying pain intensity and functional disability in such patients, yet comparative preoperative and postoperative data from South Asian clinical settings remain scarce. This study aimed to compare preoperative and postoperative pain (VAS) and disability (ODI) scores in patients with lumbar disc herniation managed surgically at a tertiary care center in Dhaka, Bangladesh. **Methods:** This retrospective comparative observational study included 60 patients with LDH who underwent surgical intervention at the Department of Orthopaedic Surgery, Ibn Sina Medical College Hospital, Dhaka, Bangladesh, between October 2024 and April 2026. Data on demographics, clinical presentation, surgical details and postoperative outcomes were extracted from medical records. VAS and ODI scores were recorded preoperatively and postoperatively. Data were analyzed using SPSS version 25.0 and paired samples t-tests were applied to compare pre- and postoperative outcomes. **Results:** The mean age was 42.7 ± 13.09 years, with a male predominance (63.3%). L4 - L5 was the most commonly affected level (58.3%). The mean preoperative VAS score was 8.73 ± 0.44, which declined significantly to 3.75 ± 0.72 postoperatively and further to 1.73 ± 0.86 at follow-up. ODI scores improved from 60.55 ± 8.18 preoperatively to 18.00 ± 5.21 at final follow up ($p < 0.001$ for all com-

parisons). Excellent or good patient satisfaction was reported in 96.7% of cases. Symptomatic recurrence and reoperation each occurred in one patient (1.7%). **Conclusion:** Surgical management of LDH produced significant and sustained reductions in both pain intensity and functional disability. These findings support the effectiveness of discectomy-based procedures in this clinical population.

Keywords

Lumbar Disc Herniation, Visual Analog Scale, Oswestry Disability Index

1. Introduction

Low back pain (LBP) is a complex musculoskeletal condition that imposes a substantial burden on individuals and healthcare systems globally. According to the Global Burden of Disease Study 2021, LBP affected approximately 619 million people worldwide in 2020 and remains the single greatest contributor to years lived with disability (YLDs) across most countries [1]. Projections suggest that by 2050, more than 843 million individuals will be affected, driven largely by population growth and demographic ageing [1]. Among the identifiable structural causes of LBP, lumbar disc herniation (LDH) occupies a prominent position. It frequently produces radicular pain and neurological compromise that significantly impair functional capacity and quality of life [2].

Lumbar disc herniation arises when the nucleus pulposus protrudes through defects in the annulus fibrosus, compressing adjacent nerve roots and generating a cascade of mechanical and inflammatory responses [3]. Epidemiological data indicate that symptomatic LDH has a point prevalence of approximately 5% in adults aged 30 years and above, with L4 - L5 and L5 - S1 representing the most commonly affected intervertebral levels. Male sex, physically demanding occupations, smoking and elevated body mass index are well-recognized predisposing factors [4]. The condition most commonly presents between the fourth and fifth decades of life, corresponding to the peak years of occupational productivity, thereby amplifying its socioeconomic significance [2].

Conservative management, including pharmacotherapy, physiotherapy and epidural steroid injections, alleviates symptoms in the majority of patients within six to twelve weeks [5]. However, surgical decompression becomes necessary in cases of persistent or worsening pain, progressive neurological deficits, or failure of adequate conservative care. Discectomy, whether performed as open fenestration discectomy, microdiscectomy, or endoscopic discectomy, remains the cornerstone of surgical treatment for LDH and has consistently demonstrated superior short-term outcomes compared with prolonged non-operative management [6]. Reported success rates with primary discectomy range from 70% to 90%, with most series noting significant improvement in both pain scores and functional

disability indices [5].

Objective measurement of surgical outcomes in spinal surgery has evolved considerably. The Visual Analog Scale (VAS) is a widely validated, patient-reported tool for quantifying pain intensity, scored on a continuous 0 - 10 scale, where 0 denotes no pain and 10 represents the worst imaginable pain [7]. The Oswestry Disability Index (ODI), a condition-specific, ten-domain questionnaire, quantifies the degree of lumbar-related functional limitation and is considered the reference standard for outcome assessment in LDH [7] [8]. A minimum clinically important difference of 12.8 points has been established for the ODI in lumbar spine surgery cohorts [8]. Together, VAS and ODI scores provide complementary and reproducible assessments of surgical efficacy that are required for reporting in modern orthopaedic literature.

Published studies from diverse settings have documented significant reductions in both VAS and ODI scores following various discectomy techniques [9] [10]. However, the published evidence from South Asian centers, particularly Bangladesh, is limited, restricting the applicability of international data to local clinical practice.

Recent studies from Bangladesh and neighbouring South Asian countries have documented comparable improvements in pain and functional outcomes following surgical intervention for LDH. Sarkar *et al.* reported significant reductions in both VAS and ODI scores following percutaneous endoscopic and open lumbar microdiscectomy in a Bangladeshi cohort at the National Institute of Neurosciences and Hospital, Dhaka [11]. Similarly, a study from a district-level hospital in Bangladesh demonstrated mean VAS improvement from 7.4 to 2.8 at 12 weeks post-surgery, with 75.89% achieving excellent outcomes [12]. These findings support the effectiveness of discectomy-based procedures across diverse healthcare settings in the region.

Regional differences in patient demographics, body habitus, occupational exposure, healthcare access and surgical infrastructure may influence outcomes and warrant dedicated investigation. Against this backdrop, the present study was undertaken to compare preoperative and postoperative VAS and ODI scores in patients with LDH managed surgically at a tertiary-level institution in Dhaka.

2. Materials & Methods

This was a retrospective comparative observational study conducted in the Department of Orthopaedic Surgery, Ibn Sina Medical College Hospital, Dhaka, Bangladesh. The study period extended from October 2024 to April 2026. Data were extracted retrospectively from the departmental medical records and operative logbooks. The final analysis was conducted in May 2026. All included patients had a minimum follow-up period of 12 months, with a mean follow-up duration of 17.18 ± 2.25 months. The hospital is a tertiary care institution that manages a wide spectrum of spinal pathologies, including degenerative disc disease and lumbar disc herniation. A total of 70 patients with lumbar disc herniation who underwent surgical intervention during the study period were initially screened for eli-

gibility. Of these, 10 patients were excluded: six had incomplete medical records or missing outcome data, two were lost to follow-up within 12 months, one had cauda equina syndrome requiring emergency surgery and one had spinal infection as the primary aetiology. The remaining 60 patients who met the eligibility criteria and had complete medical records were included in the final analysis.

2.1. Inclusion Criteria

- Adults aged 18 years and above with a confirmed MRI diagnosis of lumbar disc herniation.
- Patients presenting with low back pain and/or radicular pain refractory to at least six weeks of conservative management.
- Patients who underwent surgical decompression (fenestration and discectomy, laminotomy and discectomy, or posterior decompression with stabilization) at the study institution.
- Complete preoperative and postoperative clinical records, including documented VAS and ODI scores.
- A minimum follow-up period of 12 months.

2.2. Exclusion Criteria

- Patients with cervical or thoracic disc disease without lumbar involvement.
- Patients with spinal infections, tumours, fractures, or inflammatory arthropathies as the primary aetiology.
- Patients with cauda equina syndrome requiring emergency surgical decompression.
- Cases with incomplete medical records or absent preoperative or postoperative outcome data.
- Patients who declined consent for data use or were lost to follow-up within 12 months.

2.3. Data Collection Procedure

Data were extracted retrospectively from the departmental medical records and operative logbooks of the Department of Orthopaedic Surgery, Ibn Sina Medical College Hospital. A predesigned, structured data-extraction form was used to ensure systematic and consistent retrieval of information across all cases. The form captured patient demographics (age, sex, occupation, BMI and smoking status), clinical history (duration of symptoms, presenting complaints, previous conservative treatment, prior lumbar surgery and comorbidities), imaging findings (level and type of disc herniation, nerve root compression and Modic changes), surgical details (operative approach, operating time, intraoperative blood loss and complications) and postoperative outcomes (length of hospital stay, time to return to daily activities, time to return to work, recurrence and patient satisfaction according to the modified MacNab criteria).

The choice of surgical procedure was determined by the attending surgeon

based on the extent and location of disc herniation, presence of spinal instability and individual patient factors. Fenestration and discectomy were the preferred approach for contained or extruded disc herniations without significant spinal canal stenosis. Laminotomy and discectomy were performed when foraminal or lateral recess stenosis accompanied the herniation. Posterior decompression with stabilization was reserved for patients with pre-existing spinal instability, multilevel involvement, or degenerative spondylolisthesis.

Outcome assessment was performed at three time points for VAS score: preoperatively, in the immediate postoperative period and at the final follow-up visit and two time point for ODI score; preoperatively and at the final follow up visit. Pain intensity was measured using the Visual Analog Scale (VAS, 0 - 10) and functional disability was assessed using the Oswestry Disability Index (ODI), both of which are internationally validated, condition-specific instruments with established reliability and responsiveness in spinal surgery populations. Data were collected by two independent investigators and cross-verified against original medical documentation to minimize transcription errors and ensure internal consistency. Patient confidentiality was maintained throughout the study; all records were anonymized before analysis and individual patient identifiers were not disclosed in any part of the research output.

2.4. Ethical Considerations

As this was a retrospective observational study utilizing anonymized data extracted from existing medical records, formal institutional ethical approval was not required by the hospital's research committee. Nevertheless, the study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Patient confidentiality was strictly maintained throughout; all records were anonymized before analysis and individual patient identifiers were not disclosed in any part of the research output. Informed consent for participation was waived due to the retrospective nature of the study and data use was limited to routine clinical information collected during standard care.

2.5. Statistical Analysis

Data were entered and analyzed using IBM SPSS Statistics version 25.0. Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables were presented as frequencies and percentages. Preoperative and postoperative VAS and ODI scores were compared using the paired samples t-test. A p-value of less than 0.05 was considered statistically significant for all analyses.

3. Results

Table 1 presents the baseline demographic characteristics of the study participants. A total of 60 patients with lumbar disc herniation were included in this retrospective comparative observational study. The mean age of the study population was 42.7 ± 13.09 years, with the majority belonging to the 30 - 49 years age

group (55.0%). Male patients constituted 63.3% of the cohort. Workers represented the largest occupational category (43.3%), followed by housewives (30.0%). The mean BMI was 29.4 ± 4.4 kg/m^2, with 61.7% of patients having a BMI of 30 kg/m^2 or above. Most participants were non-smokers (61.7%), while current smokers accounted for 30.0% of cases.

Table 1. Baseline demographic and clinical characteristics of study participants (N = 60).

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	10 - 29	10	16.7
	30 - 49	33	55.0
	50 - 69	15	25.0
	≥70	2	3.3
	Mean ± SD	42.7 ± 13.09	
Sex	Male	38	63.3
	Female	22	36.7
Occupation	Student	6	10.0
	Worker	26	43.3
	Service holder	10	16.7
	Housewife	18	30.0
BMI	<30 kg/m^2	23	38.3
	≥30 kg/m^2	37	61.7
	Mean ± SD	29.4 ± 4.4	
Smoking status	Non-smoker	37	61.7
	Ex-smoker	5	8.3
	Current smoker	18	30.0

Table 2 presents the baseline clinical characteristics of the study participants. Low back pain and radicular pain were present in all patients (100%), whereas motor weakness was documented in one patient (1.7%). The mean duration of preoperative symptoms was 11.25 ± 3.82 months. All patients had received pharmacological treatment prior to surgery and 86.7% had undergone physiotherapy. A history of previous lumbar surgery was present in one patient (1.7%). The most prevalent comorbidities were hypertension and diabetes mellitus, each reported in 10 patients (16.7%).

Table 2. Clinical characteristics of study participants (N = 60).

Variable	Category	Frequency (n)	Percentage (%)
Presenting symptoms	Low back pain	60	100.0
	Radicular pain	60	100.0
	Motor weakness	1	1.7

Continued

Duration of symptoms (months)	Mean ± SD	11.25 ± 3.82	
Previous conservative treatment	Medication	60	100.0
	Physiotherapy	52	86.7
Previous lumbar surgery	Yes	1	1.7
Comorbidities	Hypertension	10	16.7
	Diabetes mellitus	10	16.7
	Cardiovascular disease	3	5.0
	Others	2	3.3
Level of herniation	L3 - L4	7	11.7
	L4 - L5	35	58.3
	L5 - S1	16	20.0
	Multiple levels	6	10.0
Type of disc herniation	Extrusion	36	60.0
	Sequestration	23	38.3
	Others	1	1.7
Nerve root compression	Present	60	100.0
Modic changes/disc degeneration	Present	11	18.3
Surgical approach	Fenestration & discectomy	46	76.7
	Laminotomy & discectomy	5	8.3
	Posterior decompression & stabilization	9	15.0

Radiological assessment identified L4 - L5 as the most frequently affected level (58.3%), followed by L5 - S1 (20.0%) and L3 - L4 (11.7%). Multi-level involvement was observed in four patients (10.0%). Disc extrusion was the predominant herniation type (60.0%), followed by sequestration (38.3%). Nerve root compression was present in all patients (100%) and Modic changes or disc degeneration were identified in 11 patients (18.3%). Fenestration and discectomy were the most frequently performed procedure (76.7%), followed by posterior decompression and stabilization (15.0%).

Table 3 presents the preoperative, postoperative and follow-up outcome measures across the study population. Marked and statistically significant improvement in both pain intensity and functional disability was observed following surgery. The mean preoperative VAS score of 8.73 ± 0.44, reflecting severe pain, declined substantially to 3.75 ± 0.72 in the postoperative period and further to 1.73 ± 0.86 at the final follow-up. Similarly, the mean ODI score decreased from

60.55 ± 8.18 preoperatively, indicating severe disability, to 18.00 ± 5.21 postoperatively, corresponding to minimal disability. Both reductions were statistically significant ($p < 0.001$). The mean length of hospital stay was 2.95 ± 1.03 days. Patients returned to daily activities at a mean of 2.02 ± 0.44 weeks and resumed work after a mean of 4.99 ± 1.26 weeks. The mean follow-up duration was 17.18 ± 2.25 months.

Table 3. Preoperative, postoperative and follow-up outcome measures (N = 60).

Variable	Value (Mean ± SD)
Preoperative VAS score (0 - 10)	8.73 ± 0.44
Postoperative VAS score (0 - 10)	3.75 ± 0.72
Preoperative ODI score	60.55 ± 8.18
Postoperative ODI score	18.00 ± 5.21
Length of hospital stay (days)	2.95 ± 1.03
Time to return to daily activities (weeks)	2.02 ± 0.44
Time to return to work (weeks)	4.99 ± 1.26

Table 4 presents the paired comparisons of preoperative, postoperative and follow-up VAS and ODI scores (preoperative vs final follow up), including mean differences and 95% confidence intervals. The mean VAS score declined by 4.98 points (95% CI: 4.80 - 5.16) from the preoperative to the postoperative assessment ($p < 0.001$) and by 7.00 points (95% CI: 6.77 - 7.23) from the preoperative period to follow-up ($p < 0.001$). A further statistically significant reduction of 2.02 points (95% CI: 1.78 - 2.26) was observed between the postoperative and follow-up time points ($p < 0.001$), demonstrating continued improvement beyond the immediate operative period. The ODI score showed a mean reduction of 42.55 points (95% CI: 40.48 - 44.62) from the preoperative to the final follow up period ($p < 0.001$), representing a clinically meaningful shift across disability categories.

Table 4. Paired comparative analysis of preoperative, postoperative and follow-up pain and disability scores at preoperative and final follow up (N = 60).

Variable	Preoperative (Mean ± SD)	Postoperative (Mean ± SD)	Mean Difference (95% CI)	p-value
VAS score (pre vs. postoperative)	8.73 ± 0.44	3.75 ± 0.72	4.98 (4.80 - 5.16)	<0.001
VAS score (pre vs. follow-up)	8.73 ± 0.44	1.73 ± 0.86	7.00 (6.77 - 7.23)	<0.001
VAS score (postoperative vs. follow-up)	3.75 ± 0.72	1.73 ± 0.86	2.02 (1.78 - 2.26)	<0.001
ODI score (preoperative vs. follow-up)	60.55 ± 8.18	18.00 ± 5.21	42.55 (40.48 - 44.62)	<0.001

Table 5 summarizes the surgical and postoperative findings. The mean operative duration was 73.75 ± 36.91 minutes, with an average intraoperative blood loss of 68.5 ± 77.97 mL. Intraoperative complications were rare; dural tear occurred in one patient (1.7%) and was managed intraoperatively without further adverse sequelae. Symptomatic recurrence was documented in one patient (1.7%), who subsequently required reoperation.

Table 5. Surgical, postoperative and follow-up findings (N = 60).

Variable	Mean ± SD/n (%)
Operating time (minutes)	73.75 ± 36.91
Intraoperative blood loss (mL)	68.5 ± 77.97
Intraoperative complication (dural tear), n (%)	1 (1.7)
Length of hospital stay (days)	2.95 ± 1.03
Time to return to daily activities (weeks)	2.02 ± 0.44
Time to return to work (weeks)	4.99 ± 1.26
Recurrence of symptoms, n (%)	1 (1.7)
Reoperation required, n (%)	1 (1.7)

Figure 1 shows the patient satisfaction at final follow-up, assessed using the modified MacNab criteria, was favourable in the large majority of the cohort. Excellent outcomes were reported in 32 patients (53.3%) and good outcomes in 26 patients (43.3%), yielding a combined excellent-to-good satisfaction rate of 96.7%. Fair and poor outcomes were each reported in one patient (1.7%).

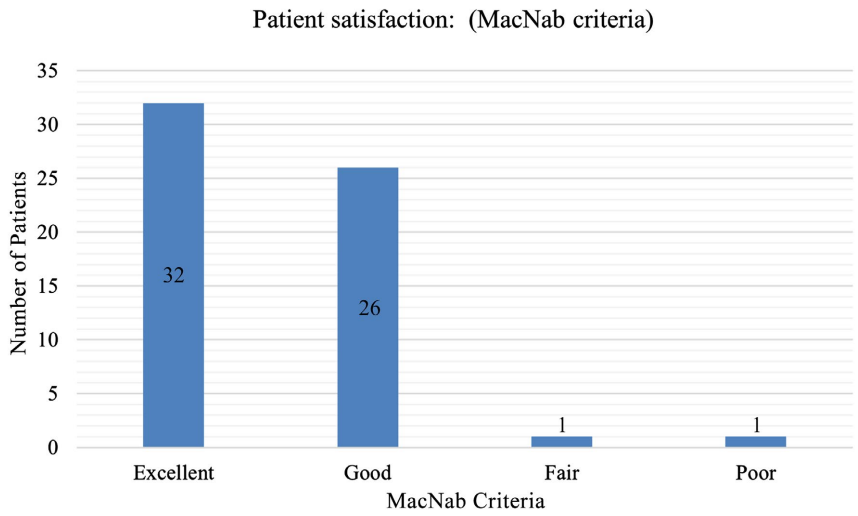

Figure 1. Patient satisfaction score (MacNab criteria).

4. Discussion

The present study examined preoperative and postoperative pain and disability

outcomes in 60 patients with lumbar disc herniation who underwent surgical decompression at a tertiary care center in Dhaka, Bangladesh. The findings demonstrate that surgical intervention was associated with highly significant reductions in both VAS and ODI scores, sustained through a mean follow-up of 17.18 months, with an overall patient satisfaction rate of 96.7%.

The magnitude of improvement observed in the present study is consistent with recently published series from comparable South Asian settings. Sarkar *et al.* reported significant postoperative reduction in both VAS and ODI scores in a Bangladeshi cohort, with percutaneous endoscopic discectomy showing more pronounced pain reduction and quicker recovery compared to open microdiscectomy ($p < 0.05$) [11]. Similarly, a district-level hospital study from Bangladesh demonstrated substantial functional recovery, with mean VAS scores declining from 7.4 preoperatively to 2.8 at 12 weeks following surgery [12]. Karim *et al.* documented comparable ODI improvement from 76.11 ± 12.81 to 5.00 ± 7.72 ($p = 0.001$) following bilateral micro-foraminotomy and micro-discectomy, reinforcing the reproducibility of favorable surgical outcomes across different techniques and clinical settings in the region [13].

The demographic profile observed in the present study is broadly consistent with published literature. The mean patient age was 42.7 ± 13.09 years, with a predominance of patients in the 30 - 49-year age group (55.0%), reflecting the well-established pattern of LDH occurring most frequently during the peak productive decades of adult life [2]. A similar age distribution was reported by Omidi-Kashani *et al.*, who documented LDH most commonly in the fourth and fifth decades [14]. The male predominance noted in the present cohort (63.3%) is concordant with findings from multiple studies, including Kulkarni and Tapashetti, whose series of large central lumbar disc herniation cases included a majority of male patients [10].

The mean preoperative VAS score of 8.73 ± 0.44 in the present study reflects a high preoperative pain burden. This is comparable to the findings of Koivunen *et al.* [8], who reported a mean preoperative VAS of approximately 8.49 in their series of LDH patients. Following surgery, the VAS score in the present study declined to 3.75 ± 0.72 postoperatively and further to 1.73 ± 0.86 at follow-up ($p < 0.001$). This trajectory of sustained pain reduction over successive time points has also been demonstrated by Kulkarni and Tapashetti, who reported a mean leg pain VAS improvement from 7.48 ± 0.9 preoperatively to 2.22 ± 0.84 postoperatively ($p < 0.05$), supporting the reproducibility of pain relief following decompressive surgery across different surgical techniques and settings [10].

Functional disability outcomes, as measured by the ODI, showed equally substantial improvement in the present study. The mean preoperative ODI of 60.55 ± 8.18 indicated severe disability, while the postoperative ODI of 18.00 ± 5.21 corresponded to minimal disability, representing a mean reduction of 42.55 points (95% CI: 40.48 - 44.62) from the preoperative to the final follow up assessment ($p < 0.001$). These findings are strikingly similar to those reported by Kulkarni and

Tapashetti, whose cohort demonstrated an ODI change from 60.53 ± 7.84 preoperatively to 18.33 ± 6.20 postoperatively ($p < 0.05$) [10]. This degree of functional improvement substantially exceeds the established minimum clinically important difference of 12.8 points for the ODI in lumbar spine surgery, confirming the clinical meaningfulness of the observed changes [9].

L4 - L5 was the most commonly involved level in this series (58.3%), followed by L5 - S1 (20.0%). This distribution aligns with the established epidemiology of LDH, wherein the lower lumbar levels are most susceptible due to biomechanical loading [4]. A comparable distribution has been reported in a large multicenter retrospective analysis, where L4 - L5 (44.4%) and L5 - S1 (36.9%) collectively accounted for over 80% of cases [15]. Disc extrusion was the predominant herniation morphology (60.0%), followed by sequestration (38.3%), consistent with the clinical presentation of severe radicular pain requiring surgical intervention in this cohort.

The mean operative duration of 73.75 ± 36.91 minutes and intraoperative blood loss of 68.5 ± 77.97 mL recorded in the present study are comparable to figures reported in open discectomy series. Hamdan *et al.* described a hospital stay of approximately 2.10 days in patients undergoing open fenestration discectomy, which is consistent with the 2.95 ± 1.03 days observed here [9]. The mean time to return to daily activities of 2.02 ± 0.44 weeks and to return to work of 4.99 ± 1.26 weeks in the present series also fall within the expected ranges documented following standard open discectomy procedures. A dural tear was the only intraoperative complication, occurring in one patient (1.7%), which is well within the reported incidence range of 1% - 5% for this complication across open and minimally invasive discectomy series [16].

Patient satisfaction assessed by the modified MacNab criteria demonstrated excellent or good outcomes in 96.7% of patients in the present study. This compares favourably with findings from comparable published series. Lee *et al.* reported good satisfaction scores following microdiscectomy, interspinous device implantation and full-endoscopic discectomy [7]. Similarly, Mao L *et al.* documented excellent or good MacNab outcomes in 87.5% and 82.35% of patients in endoscopic and microendoscopic discectomy groups, respectively [17]. The higher satisfaction rate in the present cohort may partly reflect the severity of the preoperative pain burden and the substantial magnitude of postoperative improvement. Symptomatic recurrence and reoperation each occurred in one patient (1.7%), a rate consistent with primary surgery recurrence rates of 1.7% - 5% reported in large-scale series [5].

Several factors identified in the present study warrant comment in the context of existing literature. A BMI of 30 kg/m^2 or above was present in 61.7% of patients and current smoking was documented in 30.0%. Lener *et al.* and others have demonstrated that obesity and smoking are independently associated with worse postoperative pain scores and higher risk of complications, a consideration that merits prospective evaluation in future studies from this region [18]. The mean

symptom duration of 11.25 ± 3.82 months prior to surgery in the present cohort is within the range that has been shown not to significantly influence surgical outcomes in LDH, a finding that provides reassurance regarding the eligibility criteria applied in the present study [19].

5. Limitations and Recommendations

This study is limited by its retrospective, single-center design and a relatively small sample size of 60 patients, which may restrict the generalizability of the findings to broader populations. Future prospective, multicenter studies with larger sample sizes and longer follow-up periods are recommended to further evaluate surgical outcomes and identify prognostic factors influencing recovery in lumbar disc herniation.

6. Conclusion

Surgical management of lumbar disc herniation produced clinically meaningful and statistically significant reductions in both pain intensity (VAS) and functional disability (ODI), with improvements sustained at a mean follow-up of 17.18 months. A combined excellent-to-good patient satisfaction rate was achieved. These findings confirm that discectomy-based surgical procedures are effective and safe in this patient population and support their continued use in the management of lumbar disc herniation.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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